

*The Trypanosome causing Disease in Man in Nyasaland.—
The Naturally Infected Dog Strain. Part IV.—Experiments
on Immunity.*

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(Received May 5,—Read June 25, 1914.)

INTRODUCTION.

The following experiments were undertaken to find out whether the Naturally Infected Dog strain of the trypanosome causing disease in man in Nyasaland would protect against the other strains. These different strains have been described in previous papers as the "Human," the "Wild Game," the "Wild *Glossina morsitans*," "Zululand, 1913," etc., and here they will be known by the same names. "Human" will therefore mean a strain of this species of trypanosome coming from man, "Wild *G. morsitans*" from a tsetse fly, and so on.

These immunity experiments were necessarily one-sided, as it was, with three exceptions, only animals which had recovered from the weaker Naturally Infected Dog strain which were available.

There are practically no recoveries from the Human and other strains. One goat apparently recovered from the Mzimba strain, and a goat, monkey and dog from the Wild *G. morsitans* strains, and are included.

There are, therefore, no completed cross-inoculation experiments—or at least only one unsatisfactory one, Experiment 17—as would have been carried out if material had been forthcoming.

It will be seen from the following experiments that the Naturally Infected Dog strain failed to immunise animals against the Human, Wild *G. morsitans*, and Zululand, 1913, strains; but it is not known whether these strains, on the other hand, would have immunised animals against the Naturally Infected Dog strain or not:—

Experiment 1, Dog 459, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. April 20 ...	459	From Dog 317.....	Naturally infected Dog 48	19	R.
Nov. 22 ...	459	From Guinea-pig 1333	Human	4	59

Remarks.—Dog 459, which had recovered from Naturally Infected Dog Strain 48, when inoculated with a Human strain died in 59 days.

Conclusion.—The Naturally Infected Dog strain does not protect against the Human Strain IV, Chipochola.

Experiment 2, Monkey 1792, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1913. Jan. 22 ...	1792	From Rat 1741	Naturally infected Dog 48	5	R.
June 24 ...	1792	From Rat 2167	Naturally infected Dog 2033	—	—
July 12 ...	1792	From Rat 2235	Human	9	61

Remarks.—Monkey 1792, which had recovered from Naturally Infected Dog Strain 48, and proved immune to Naturally Infected Dog Strain 2033, succumbs to the Human strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Human strain, Yoramu.

Experiment 3, Monkey 1793, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1913. Jan. 22 ...	1793	From Rat 1741	Naturally infected Dog 48	5	R.
June 24 ...	1793	From Rat 2167	Naturally infected Dog 2033	—	—
July 12 ...	1793	From Rat 2235	Human	5	9

Remarks.—Monkey 1793, which had recovered from Naturally Infected Dog Strain 48, and proved immune to Naturally Infected Dog Strain 2033, succumbs in nine days to the Human strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Human strain, Yoramu.

Experiment 4, Monkey 2164, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1913. May 14 ...	2164	From Rat 2091	Naturally infected Dog 2033	—	—
June 14 ...	2164	From Dog 2157	Naturally infected Dog 2033	—	—
July 31 ...	2164	From Rat 2285	Naturally infected Dog 48	—	—
Dec. 17 ...	2164	From Rat 2437	Human	7	Alive 1.3.14

Remarks.—Monkey 2164, which was proved to be immune against the Naturally Infected Dog Strains 2033 and 48, reacts readily to the Human strain.

Conclusion.—Immunity to the Naturally Infected Dog strain does not imply immunity to the Human strain, Dongolosi.

Experiment 5, Dog 690, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. July 17 ...	690	Naturally infected	Naturally infected Dog 690	?	R.
Nov. 22 ...	690	From Rat 1492	Naturally infected Dog 48	—	—
Dec. 20 ...	690	From Dog 1675	Wild <i>G. morsitans</i>	10	43

Remarks.—Dog 690, which had recovered from Naturally Infected Dog Strain 690, and proved immune to Naturally Infected Dog Strain 48, succumbs in 43 days to the Wild *G. morsitans* strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Wild *G. morsitans* strain.

Experiment 6, Dog 1530, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. Oct. 29 ...	1530	From Rat 1491	Naturally infected Dog 48	16	R.
1913. March 21 ...	1530	From Rat 1991	Naturally infected Dog 48	—	—
April 11 ...	1530	From Guinea-pig 2034	Wild <i>G. morsitans</i>	10	23

Remarks.—Dog 1530, after having recovered from Naturally Infected Dog Strain 48, and shown to be immune on reinjection, readily succumbs to one injection of the Wild *G. morsitans* strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Wild *G. morsitans* strain.

Experiment 7, Monkey 1534, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. Oct. 2...	1534	From Rat 1491	Naturally infected Dog 48	6	R.
1913. March 21...	1534	From Rat 1991	Naturally infected Dog 48	—	—
April 11 ...	1534	From Rat 2020	Wild <i>G. morsitans</i>	6	17

Remarks.—Monkey 1534, having recovered from Naturally Infected Dog Strain 48, and proved to be immune to the same strain, succumbs in 17 days to the Wild *G. morsitans* strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Wild *G. morsitans* strain.

Experiment 8, Monkey 1630, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. Nov. 22 ...	1630	From Monkey 1534.....	Naturally infected Dog 48	10	R.
1913. March 21...	1630	From Rat 1991	Naturally infected Dog 48	—	—
April 11...	1630	From Guinea-pig 2034	Wild <i>G. morsitans</i>	13	85

Remarks.—Monkey 1630, having recovered from Naturally Infected Dog Strain 48, and shown to be immune on re-injection, succumbs to the Wild *G. morsitans* strain.

Conclusion.—The Naturally Infected Dog strain does not protect against the Wild *G. morsitans* strain.

Experiment 9, Goat 427, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. April 20...	427	From Rat 392	Naturally infected Dog 48	10	R.
1913. Jan. 22...	427	From Rat 1741	Naturally infected Dog 48	—	—
Feb. 11...	427	From Rat 1375	Naturally infected Dog 48	—	—
Feb. 28...	427	From Dog 1906 and Rat 1832	Zululand, 1913	38	54

Remarks.—Goat 427 has recovered from Naturally Infected Dog Strain 48, and has shown no reaction to two re-injections, but when inoculated with *T. brucei*, Zululand, 1913, takes the disease and dies in 54 days.

Conclusion.—The Naturally Infected Dog strain does not protect against *T. brucei*, Zululand, 1913.

Experiment 10, Goat 432, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. April 20 ...	432	From Rat 392	Naturally infected Dog 48	26	R.
1913. Jan. 22 ...	432	From Rat 1741	Naturally infected Dog 48	—	—
Feb. 11 ...	432	From Rat 1735	Naturally infected Dog 48	—	—
Feb. 28 ...	432	From Dog 1906 and Rat 1832.	Zululand, 1913.....	31	143

Remarks.—Goat 432 has recovered from Naturally Infected Dog Strain 48, but succumbs to *T. brucei*, Zululand, 1913.

Conclusion.—The Naturally Infected Dog strain does not protect against *T. brucei*, Zululand, 1913.

Experiment 11, Sheep 456, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. April 20 ...	456	From Rat 392	Naturally infected Dog 48	5	R.
1913. March 21...	456	From Rat 1991	Naturally infected Dog 48	—	—
1914. Jan. 7 ...	456	From Rat 2470	Zululand, 1913	10	Alive 1.3.14

Remarks.—Sheep 456 has recovered from Naturally Infected Dog Strain 48, but reacts when exposed to the virus of *T. brucei*, Zululand, 1913.

Conclusion.—The Naturally Infected Dog strain does not protect against *T. brucei*, Zululand, 1913.

Experiment 12, Dog 1253, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. Sept. 6 ...	1253	From Rat 1218	Naturally infected Dog 48	6	R.
1913. Jan. 4 ...	1253	From Rat 1570	Naturally infected Dog 48	5	R.
Jan. 17 ...	1253	From Rat 1734	Naturally infected Dog 48	—	—
Feb. 28 ...	1253	From Dog 1906 and Rat 1832	Zululand, 1913	6	48

Remarks.—Dog 1253 has recovered from Naturally Infected Dog Strain 48, but succumbs to *T. brucei*, Zululand, 1913.

Conclusion.—The Naturally Infected Dog strain does not protect against *T. brucei*, Zululand, 1913.

Experiment 13, Monkey 1794, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1913. Jan. 22 ...	1794	From Rat 1741	Naturally infected Dog 48	—	—
Feb. 28 ...	1794	From Rat 1945	Naturally infected Dog 48	—	—
May 23 ...	1794	From Monkey 2181.....	Naturally infected Dog 48	—	—
June 11 ...	1794	From Monkey 2184.....	Naturally infected Dog 48	—	—
„ 24 ...	1794	From Guinea-pig	Zululand, 1913.....	9	42

Remarks.—Monkey 1794 has been proved to be immune to Naturally Infected Dog Strain 48, but when exposed to the Zululand strain succumbs.

Conclusion.—Immunity to the Naturally Infected dog strain does not imply immunity to *T. brucei*, Zululand, 1913.

Experiment 14, Monkey 1798, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1913. Jan. 22 ...	1798	From Monkey 1630.....	Naturally infected Dog 48	—	—
Feb. 28 ...	1798	From Rat 1945	Naturally infected Dog 48	—	—
May 22 ...	1798	From Monkey 2181.....	Naturally infected Dog 48	—	—
June 11 ...	1798	From Monkey 2184.....	Naturally infected Dog 48	—	—
June 24 ...	1798	From Guinea-pig 2225	Zululand, 1913.....	9	15

Remarks.—Monkey 1798 has been proved to be immune to Naturally Infected Dog Strain 48, but succumbs to *T. brucei*, Zululand, 1913.

Conclusions.—The Naturally Infected Dog strain does not protect against *T. brucei*, Zululand, 1913.

Experiment 15, Monkey 2161, Naturally Infected Dog Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days or recovery.
1913. May 14 ...	2161	From Rat 2091	Naturally infected Dog 2033	—	—
June 14 ...	2161	From Dog 2157	Naturally infected Dog 2033	—	—
July 31 ...	2161	From Rat 2285	Naturally infected Dog 48	—	—
Dec. 17 ...	2161	From Rat 2451	Zululand, 1913	7	Alive 1.3.14

Remarks.—Monkey 2161, proved to be immune to Naturally Infected Dog Strains 2033 and 48, shows no immunity to *T. brucei*, Zululand, 1913.

Experiment 16, Goat 639, Wild *G. morsitans* Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. June 12 ...	639	From Rat 543	Wild <i>G. morsitans</i>	12	R.
1913. Jan. 22 ...	639	From Rat 1741	Naturally infected Dog 48	—	—
Feb. 11 ...	639	From Rat 1735	Naturally infected Dog 48	—	—
Feb. 28 ...	639	From Dog 1906 and Rat 1832	Zululand, 1913	10	48

Remarks.—Goat 639 has recovered from the Wild *G. morsitans* strain, has shown no reaction when inoculated with Naturally Infected Dog Strain 48, but is killed in 48 days by *T. brucei*, Zululand, 1913.

Conclusion.—The Wild *G. morsitans* strain, combined with the Naturally Infected Dog strain, has no protective power against *T. brucei*, Zululand, 1913.

Experiment 17, Monkey 970, Wild *G. morsitans* Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. July 24...	970	From Rat 658	Wild <i>G. morsitans</i>	8	R.
1913. Jan. 2...	970	From Rat 1664	Wild <i>G. morsitans</i>	—	—
" 17...	970	From Rat 1740	Wild <i>G. morsitans</i>	—	—
Feb. 4...	970	From Rat 1814	Naturally infected Dog 48	9	R.
,, 28...	970	From Rat 1945	Naturally infected Dog 48	—	—
March 15...	970	From Guinea-pig 1657	Human	9	71

Remarks.—Monkey 970, after recovering from the Wild *G. morsitans* strain, shows a reaction to Naturally Infected Dog Strain 48, and finally succumbs to a Human strain.

Conclusion.—The Wild *G. morsitans* strain does not protect against the Naturally Infected Dog strain, nor does the combination of the two against the Human Strain V, Chibibi.

Experiment 18, Dog 602, Wild *G. morsitans* Strain.

Date.	Expt.	Source of virus.	Strain of trypanosome.	Period of incubation, in days.	Duration of disease, in days, or recovery.
1912. May 31 ...	602	Wild flies	Wild <i>G. morsitans</i>	5	R.
Nov. 22 ...	602	From Guinea-pig 1333	Human	6	28

Remarks.—Dog 602, which had recovered from the Wild *G. morsitans* strain, when inoculated with a Human strain died in 28 days.

Conclusion.—The Wild *G. morsitans* strain does not protect against the Human Strain IV, Chipochola.

CONCLUSIONS.

1. The Naturally Infected Dog strain does not protect animals from the Human, Wild *G. morsitans*, and Zululand, 1913, strains.
2. The Wild *G. morsitans* strain and the Naturally Infected Dog strain do not protect animals from the Human or the Zululand, 1913, strain.
3. The Wild *G. morsitans* strain does not protect against the Human strain.
4. In spite of the damaging evidence of these experiments, the Commission still holds the opinion that the Naturally Infected Dog strain is a weak strain of the trypanosome causing disease in man in Nyasaland, *T. brucei vel rhodesiense*.